

Use of Full Polarimetric SAR Data in Image Interpretation for PACRIM AIRSAR-1/2 Campaigns: Overview of Recent Results of the US NAVY ONR NICOP WIPSS Collaboration on Use of AIRSAR Data

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In conjunction with the international efforts of advancing Radar Polarimetry, Radar Interferometry and Polarimetric-Interferometric SAR imaging, the US NAVY, Office of Naval Research (ONR), International Field Office (IFO) established a Naval International Cooperative Opportunities Program (NICOP) on Wideband Interferometric-Polarimetric Sensing and Surveillance (WIPSS) in 1992. This cross Atlantic effort has grown ever since; and resulted in the ONR-NICOP-WIPSS Collaboration which was recently joined by the European Community (EC), Training and Mobility of (post-doctoral) Researchers (TMR) in Polarimetric Interferometric Radar Imaging (PIRI). Recent progress was reported during the IGARSS-GA-99-Hamburg, JOINT NICOP-TMR Workshop. The desire was expressed to further expand the Collaboration into the Southern and Northern Pacific Rim region by integrating the PAC-RIM AIRSAR program into our well performing international collaboration on advancing Air/Space-borne fully coherent (complex 2x2 scattering matrix) Polarimetric, Interferometric and Polarimetric-Interferometric SAR Imaging for the Geo-environmental Stress-Change Monitoring of the Terrestrial Covers.

It is the intent of our Collaborators to expand and to have the ONR-NICOP+EC-TMR be joined by the NASA-JPL PACRIM POL-IN-SAR expert science community. We are seeking research partners with access to their own National air/space-borne POL/IN/ POL-IN-SAR imaging platforms such as for example the DLR-IHFT E-SAR, the DCRS-DDRE EMI-SAR, the CCRS-ESD CON-SAR, and especially the NASA-JPL AIRTOPSAR in order to improve our POL-IN-SAR imaging algorithms, data collection and calibration procedures. This is accomplished by exchanging selected and evaluating by various collaborating centers concurrently well calibrated data sets of specific test sites for which reliable well-calibrated ground-truth data exist and are continuously updated.

During recent International Meetings attended by some or all WIPSS Collaboration members such as during RADAR-99/Brest, France; ICARS-99, Ottawa, Canada; IGARSS-99, Hamburg, Germany; URSI-GA-99, Toronto, Canada; and other workshops such as the NASA-JPL AIRSAR Meetings, it became clearly evident that several major issues need to be addressed such as: (1) on improving the implementation of fully polarimetric (scattering matrix) image data sets, preferably in SLC (Single Look Complex) format; (2) using the scattering matrix decomposition algorithms developed by Huynen, Barnes-Holm and Krogager, van Zyl and by Cloude-Pottier; (3) utilizing the Entropy-Alpha unsupervised POL-SAR image characterization algorithms developed by Cloude and Pottier; and (4) the POL-DEM recovery from pure POL-SAR image data sets of Schuler, Lee and Pottier for the highly improved interpretation of POL-SAR images. Explicit use will be made of implementing NASA-JPL AIR-SAR image data sets only during this forthcoming workshop by utilizing PACRIM-I image data sets and the related ground truth collections.

Time permitting, also an introduction of most recent advances of the POL-IN-SAR Repeat - Pass Image Interferometry, utilizing the POL-IN-SAR algorithms developed by Cloude, Papathanassiou and Treuhaft will be given utilizing next to AIRTOPSAR, also E-SAR, EMI-SAR also SIR-C/X-SAR image data sets (collected for the Thien Shan 1232.20 and 150.20 repeat orbital passes of 1994 October 08 and 09, respectively).

The presentation will be concluded with an invitation for PACRIM research experts in POL-IN-SAR Image analysis to join our NICOP-TMR Collaboration of which NASA-JPL has already become a productive contributor next to providing essential POL-IN-SAR image data sets of selected sites with well calibrated ground truth.

[1] W.M. Boerner et al., "Polarimetry in Radar Remote Sensing: Basic and Applied Concepts", Chapter 5 in F.M. Henderson and A.J. Lewis, (ed.), "Principles and Applications of Imaging Radar". Vol. 2 of Manual of Remote Sensing, (ed. R.A. Reyerson), Third Edition, John Wiley & Sons, New York, 1998

[2] W-M. Boerner and J. S. Verdi, Recent Advances in Polarimetric Tomographic (Multi-Interferometric) SAR POL-IN/TOMO-SAR Theory & Technology and its Applications, Radar-99, Keynote Tutorial Address, Brest, Bretagne, France, 1999 May 18